TMF

November 1990

THE MAC FLYER - For Greater Safety in MAC Air Operations

A C-9 Sortie . . . page 16

TMF

THE MAC FLYER—For Greater Safety in MAC Air Operations

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Cover photo: An infant in an incubator is carried down the litter ramp.

ONLY 151 DAYS LEFT . . . .

Yes, as of 1 November 1990, there are only *151* days left! No, not until Christmas . . . until you, yes *you*, submit your entry to the 1991 MAC Flight Safety Writing Contest.

You're all instilled with a deep sense of safety consciousness and should be ready to share your safety philosophy with others. All you need to do is grab or borrow a typewriter, pound out your story—be it poetry or prose—proofread, revise and proofread it again and send it to us.

A couple of hints for those of you who have never entered our contest: first, each entry must have an aviation safety/mishap prevention message; secondly, all work must be original and unpublished. Copyright laws make us nervous. Finally, just follow the rules below. Don't procrastinate.

THE RULES

The 1991 MAC Flight Safety Writing Contest is conducted according to MACR 900-3 and these rules. Entries must be original, unpublished, contain an aviation safety/mishap prevention message, and be postmarked no later than 31 March 1991. Stories must be between approximately 1,000 and 3,000 words long (about 6 to 14 double-spaced types pages). Poetry should average 75 to 100 lines. Manuscripts must be typed, double-spaced, and submitted in two copies. Identify entries by title only and attach a cover sheet indicating author's name, address, duty phone, unit, and home address. Please include a brief biography.

The contest is open to all. Entries qualifying under the above rules earn their author a complimentary one-year subscription to *TMF*. However, desk sets and plaques may only be awarded to military members and civilian employees of the Department of the Air Force and Air Reserve Components. Other entries may be selected for Honorable Mention Special Category.

Winning entries will be published in *TMF*.

Submit to:

MAC Flight Safety Writing Contest, 1991
HQ MAC/IGFE
Scott AFB, Illinois 62225-5101

Col. Donald E. Loranger, Jr.

The New IG Speaks out on Safety

Our Job is to Manage Risk

By Lt. Col. Richard L. Buck
Supervising Editor

"We participate in a business which is inherently dangerous. Therefore, our challenge is to manage the risk associated with it, and get the mission done." These words by Col. Donald E. Loranger, Jr., who assumed duties as the MAC Inspector General on 1 September 1990, summarize his safety philosophy and how it applies to MAC. "Accordingly, judgment becomes the single most important commodity in pursuing mission accomplishment and doing so safely. Certainly, there is a role for all the many and varied rules, regulations, and technical guidance we provide our people. However, all those "guidelines" take a backseat to judgment and common sense. In short, our time-proven method of getting the job done is to attract good people, train them very well, provide them the proper working environment, and get out of the way."

Colonel Loranger stressed the role of managers and supervisors in the prevention of flight mishaps. He said, "It's a cliche' that it's a commander or supervisor's program, but like anything else to do with leadership, the first and foremost job of the leader is to provide the proper environment. The commander or supervisor accomplishes this when he ensures his people are trained, motivated, and aware of the barriers to safety and the mission. We must strive to give our people the opportunity to meet our high expectations—they will do it every time."

Regarding specific safety goals for MAC, Colonel Loranger acknowledges the difficulty in attaining perfection. "Accidents represent more than just waste and inefficiency. They represent tragedy and perhaps even the inability to get the mission done. While I'm not one to have unrealistic goals, we would be foolish to say anything above 'zero' mishaps is acceptable, because it isn't. We must continue to strive toward an environment that allows us to get our job done, yet get it done safely."

Colonel Loranger also has some specific ideas on the role of aircrew standardization in MAC's mishap prevention program. "In a sense, they go hand in hand. We ask crews to operate in a very highly complex global environment. As we speak, our safety program is being put to the test. The value of our program is being made manifest in DESERT SHIELD right now and will continue to be for the foreseeable future. As those crews operate in that complex environment, our standardization program has provided them a framework of action that time has proven is the way to operate our machines."

The balance between flight safety and the demands placed on MAC crews during contingencies

and exercises is receiving widespread attention. Colonel Loranger put the balance into perspective when he said, "Safety is just as important today as it was the day before DESERT SHIELD, if not more so. You are not going to be able to project military power and defend United States national interests abroad, with airlift, unless you can do it safely. In time of crisis, we reap the fruits of our safety program—getting the job done when it counts."

Motivation has been a key issue in all areas of MAC operations for many years. When asked for his views on factors which motivate MAC aircrews to fly safely, Colonel Loranger was very straightforward. "Common sense, good leadership, and the proper environment are the essential building blocks. We've provided our people a framework within which to operate their equipment. We've told them what our goals and objectives are, and common sense will lead them to operate their equipmemt in a safe, prudent manner. Commanders have to set priorities, provide the environment, and instill awareness. Our people will respond accordingly."

When asked how MAC's mishap prevention efforts measure up when compared with other Air Force Commands, Colonel Loranger said, "What I find remarkable about MAC, is our ability to do our mission in a diverse and interdependent global environment. Currently, our system is being tested to the limit. We are embarking on a massive airlift operation the likes of which the world has never seen in terms of distance, tonnage, and personnel airlifted. We are doing so within a complex system of crewed aircraft, sustained by a vast and interdependent support network. This airlift system, as it is known, depends on virtually thousands of people working together in a safe and efficient manner. The fact that we're able to do that efficiently and safely is pretty remarkable and speaks most positively of our commanders and supervisors—and their safety programs."

Human factors remain the weakest link in our mishap prevention program. In an effort to reduce the number of human factor-related mishaps, Colonel Loranger stressed, "having high expectations of our people. We should trust them and expect them to perform at the highest level. Human nature and past history have shown that they succeed. It's only if we don't have confidence in them, don't give them the proper tools in terms of training and expertise, and don't expect them to do very well that they would meet our worst expectations."

"Safety is just as important today as it was the day before Desert Shield, if not more so."

The new Inspector General had some definite guidelines for the safety officers and NCOs throughout the command. "Safety officers and NCOs are really tools of the commander and supervisor. Our safety professionals are there to assist them in providing the right kind of environment and the right kind of training for our people. I think safety people must be very, very creative and proactive. It's no secret that safety meetings are not the biggest sellers in the world when approached without imagination. Take somebody with a little creativity, let them put on a safety skit or some other type of interesting, imaginative program, and people will learn and remember. Help your commander by being proactive and creative—use your imagination so others will use theirs."

Colonel Loranger has been entrusted with supervising the architecture of MAC's 'quality' program. "Safety programs and quality are very consistent with each other. The quality program is one which seeks to eliminate waste and rework. An operation which is unsafe is by definition one which has all sorts of waste and rework. If you're going to have a quality operation, you do it right, you do it right the first time, and you do it right without wasted effort. That's a major consistency between the two. Moreover, the quality program places great trust in individuals and expects them to rise to expectations. It empowers them by giving them the authority, the responsibility, and the accountability to do the job they've been asked to do. So, in many ways, you can say that safety and quality programs are virtually synonymous. Safety is merely a specialized aspect of the quality program. If you have a quality program, it will be safe.

When asked for any closing observations he might like to make, Colonel Loranger said, "We are part of a great command and play a growing and pivotal role in our nation's ability to defend our global interests. If we continue to do our mission and do it safely, we will always be *Proud MAC: Support America can always count on.*"

Thank you, Colonel Loranger, for your comments. ★

Excellence in Airmanship

SSgt. Samuel J. Alden, 17th Tactical Airlift Squadron, Elmendorf AFB, Alask.; was flying a C-130H night personnel airdrop mission, on 20 Mar 1990, when the crew experienced a drop malfunction. Sergeant Alden was the primary loadmaster stationed at the left paratroop door, while SSgt. Barry Stone, the secondary loadmaster, was stationed at the right paratroop door. Ten jumpers exited from each side of the aircraft and the Army jumpmaster reported all jumpers clear. While completing the drop checklist, Sergeant Alden noticed Sergeant Stone having trouble manually retrieving the jumper's static lines from the right door. He quickly informed the pilot of the problem and positioned himself in the door, head and upper torso outside the aircraft, to look back. In the pitch dark behind the aircraft he spotted the flailing arms and legs of a paratrooper entangled in the trailing static lines. Sergeant Alden immediately notified the pilot and prepared for emergency retrieval of the towed trooper. By the time the pilot was notified, the aircraft was already away from the drop zone and flying over a large channel of icy water which precluded cutting the jumper free. Had the towed paratrooper fallen in the water, he would have probably died of hypothermia within 20 minutes (if he didn't drown first). Within 30 seconds, the retrieval began. Sergeant Alden anchored himself to a lifeline and stood in the doorway while Sergeant Stone operated the static line retriever. Sergeant Alden knew if the static line retriever snapped, the jumper would likely sling back and separate from the aircraft. As the static line retriever reeled the jumper closer to the doorway, Sergeant Alden, with complete disregard for his own safety, stepped into the doorway and, with both hands, grabbed the parachutist still in the slipstream outside the aircraft. At that moment his worst fears were realized—the retriever line broke. As he felt the jumper lurch back,

he mustered all of his strength and hauled the jumper and himself back into the aircraft. As the crew set up for an emergency return to Elmendorf AFB, Sergeant Alden helped analyze the extent of the trooper's injuries, administered first aid, and secured him in the aircraft to prevent further injury. Sergeant Alden's quick thinking and professionalism prevented loss of life and possible damage to an aircraft. He deserves the MAC Excellence in Airmanship Award. Well done from the staff of *TMF*.

Maj. John G. H. Jackson and Crew, 301st Military Airlift Squadron, Travis Air Force Base, Calif., were on a routine local training mission when the nose landing gear of the C-5 they were flying failed to extend prior to a touch-and-go landing. The crew had just completed a touch-and-go and were in the process of executing another one, when they experienced a "red wheels" condition on the nose landing gear, indicating it was still in transit. The main landing gear showed a "green wheels" condition, indicating it was down and locked. While the nose gear doors indicated fully open and locked, the nose gear itself was in an unknown in-transit position.

Major Jackson directed MSgt. Columbus Taylor, Jr., FE, to begin troubleshooting procedures by first checking the Malfunction Analysis and Detection Recording System (MADAR). The scanner, SSgt. Robert D. Vigesaa, went below to fiber-optically scan the nose gear while MSgt. Robert W. Garcia,the other FE, checked all related circuit breakers. Sergeant Garcia and Sergeant Taylor carried out the Dash One troubleshooting procedures while Major Jackson directed Capt. Donald L. Rees, copilot, to request and plan for a holding pattern. Capt. Martin A. McConnell, in the jumpseat, alerted Command Post. Meanwhile, the scanner determined the nose gear had travelled approximately 25 percent of the way from the fully retracted position. Major Jackson took charge of all troubleshooting procedures while Captain Reese closely monitored traffic, handled all radio calls, and assisted in flying the holding pattern. Subsequently, every emergency procedure for nose gear extension was complied with, unsuccessfully. Major Jackson requested a "Conference Skyhook" which resulted in the key integration of the Standardization sections of 22 AF, 60 MAW Maintenance, HQ MAC, and Lockheed. Standardization supervisors on the ground recommended the crew try a specific modified emergency procedure. As Major Jackson carried out this procedure, a circuit breaker popped on the emergency motor for the nose gear. He then reaccomplished all troubleshooting procedures involving the nose gear emergency motor, again unsuccessfully. Under 60 MAW Maintenance direction, Major Jackson attempted to unkneel the nose gear. This attempt was also unsuccessful. Standardization approved the recycling of the nose gear, but this attempt was uneventful as well. During this time, Captain McConnell assisted the pilots by handling Conference communications. Next, Major Jackson made an effort to exert extra gravitational force on the nose gear by applying significant control wheel pressure. This procedure failed as well, and Major Jackson elected to declare an emergency and land nose gear up.

He directed the scanner, Sergeant Vigesaa, to secure the nose gear emergency hydraulic isolation valve, which he did by employing an oxygen bottle harness. The FEs depressurized the aircraft and removed the Number 2 escape hatch. Emergency landing conditions were reviewed as the crew prepared for the emergency landing. As a fire prevention measure, Major Jackson directed the FEs to activate the Fire Suppresion system in order to supply liquid nitrogen to the nose wheel well plus the forward under-floor cargo area.

Major Jackson brought the C-5 down on its main landing gear while holding the nose gear high for approximately the first 4,000 feet of runway. As the aircraft reduced speed, Major Jackson applied the thrust reversers to all engines and continued to keep the C-5's nose gear off. With aircraft speed and momentum rapidly decreasing, Major Jackson eased the nose down on the runway. As the nose finally touched the runway surface, the crew prepared for a possible emergency egress situation. Bringing the aircraft to a complete stop, Major Jackson received confirmation from the engineers that there was no sign of fire. The crew quickly egressed the aircraft. Initial inspection revealed minimal damage to the underside of the nitrogen-soaked nose gear area.

Major Jackson and crew's professional efforts and crew coordination resulted in saving a valuable Air Force resource without loss of life. They deserve the MAC Excellence in Airmanship Award. Congratulations from the *TMF* staff.

"M"boy, We Didn't Need Aircrew Coordination Training in my Day."

The Master of Realistic Training

By Maj. Richard A. Pilling and the C-17 ATS
Pilots and Loadmaster SMEs of MAC and MDTSI
OL V, MACOS, Norman, Okla.

(Editor's Comments: The following story was submitted prior to C.R.'s resurrection in TMF. Board members liked the story so well they awarded it an Honorable Mention and recommended we print it as written.)

The Ace of Aerospace reluctantly buckled the seldom-used seat belt of his rusting-but-running green E-type Jag. The main gate of Airlift U. was just ahead. "Working for an Aircrew Training System Contractor isn't so bad," he muttered. "Heck, they haven't even bugged me about my carefully cultivated physique."

The last few years certainly flew by, he thought. Recently retired, he recalled the highlights of recent years. First, the system began to emphasize commander involvement in the assignment process. "That explains the long tour at Iceberg NAS as the Beach Erosion and Vending Machine Inventory Control Officer, a job Col. Fang found me. Shoot," the Paunchus Pilot said aloud, "Sherpas were designed to operate off the hard surface. Those Lufthansa pilots were just jealous I could land between them on the taxiway at Frankfurt. And my retirement ceremony was the best." Looking down, he gazed at the custom-embroidered, grape-jelly-stained 45,000-hour patch emblazoned on his already rumpled leather flight jacket. "Nobody in MAC can ever match me."

Seeking to continue his lethargic legacy, he sent out the requisite resumes. Surprisingly, a couple of airlines were impressed with his unquestionably unique flying skills; however, chain-smoking his gold-ringed Egyptian Ovals during the interviews didn't seem to impress the medical examiners. Resigned to the inevitable, the Silver-Tongued Fox cashed in some old MATS green stamps for a job with one of the new ATS operations. "The paperwork is the pits," he moaned. "At least I talked them into regular observation rides to keep this lean, mean aviatin' machine in shape."

Baffling to all, his new boss, Dr. C. B. Trayner, couldn't do without him. In fact, C.B. gave the World's Greatest Airlifter the prime job of rewriting the current Aircrew Coordination Training lesson. As he handed him the lesson specifications, Dr. Trayner said with longing admiration, "Everyone I talked to said, 'Nobody handles a crew or an emergency like C.R. Terror'."

"This Instructional Systems Development or ISD is just malarkey!" said C.R. to his boss. "When you want to teach a flier something, you gotta get out of these cinderblock classrooms, and into the air. That's where you know if he . . . or she (C.R. added reluctantly) has what it takes. Besides, this ACT stuff is too

HONORABLE MENTION
1990 MAC FLIGHT SAFETY WRITING CONTEST

touchy-feely; 'I'm Okay, You're Okay,' kinda stuff." Then, knowing how proud Dr. Trayner was of his academic achievements, C.R. laid out his plan.

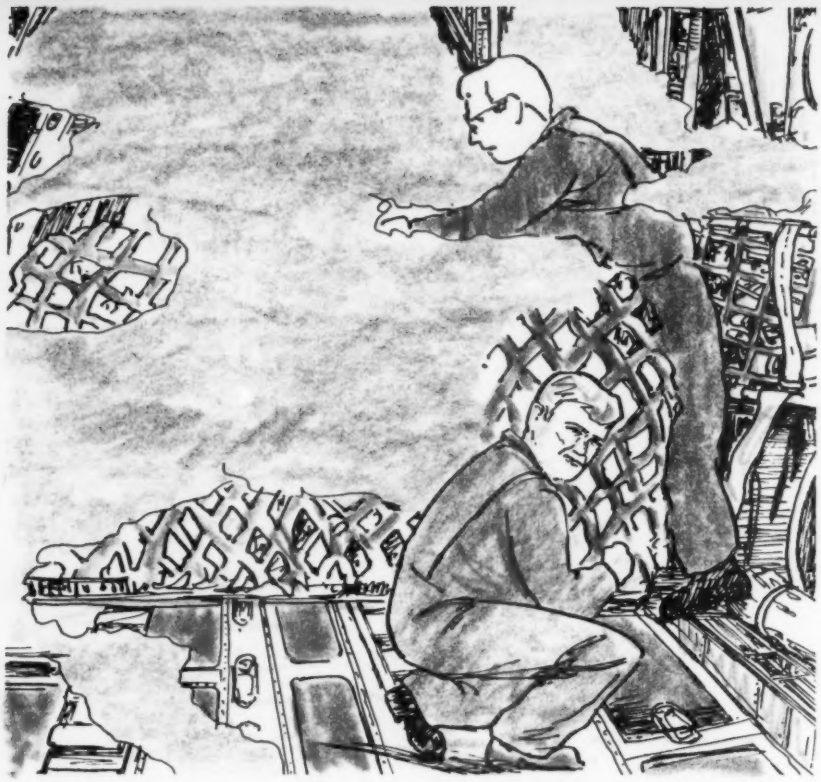
"What we need to do is a SGTO, yeah, that's it. A small group tryout, within the contractually required formative evaluations, supporting our proposed transfer of training concepts," he said straight-faced, yet not quite understanding what he had said.

"You know, Terror, you've got something there. There is no empirical data on the actual changes to behavior as a result of cockpit resource management training. We can certainly add to the body of research in this area. Give me a training scenario and we'll implement it into our flight training syllabus," Dr. Trayner answered, certain his place in academia was now secure.

The Author with Avoirdupois threw himself at his work with new-found vigor. After exhaustive research, several drafts, and a conference with the Instructional Designer, C.R. presented his lesson specifications.

"I've never seen you work so hard as in these last 30 minutes, Terror," exclaimed C. B. "Show me what you've got."

C.R. proposed a local flight to a near by aux field where an engine would fail while simultaneously a fire would erupt in the cargo compartment. The IP would brief the crew that ACT would be accomplished on the flight and prepare the crew for an unspecified simulated emergency situation. The emphasis would be on the crew collecting information and communicating clearly to the AC. The AC would be judged on his



ability to assimilate the information and direct the crew actions.

"Perfect," Dr. C. B. Trayner said. "C.R., how'd you like to record the performance on one of your observation rides?"

"Love to!" the Former Field-grade Fumbler blurted. "I'll get it on the schedule right away."

This local airdrop is perfect, C.R. thought. These guys are all current and qualified and should be able to handle the scenario. You know C.R. ol' boy, Terror plotted to himself, if it's research Dr.Videoscreen wants, I could really give him some data. Imagine, if I don't give away that I'm observing and kinda spring it on 'em, we'll really get some good stuff. Convinced that he was on the verge of ACT stardom, the Master Manipulator waddled to the briefing. Upon entering the darkened auditorium, five minutes late, the Infamous Inert Deviser heard the low frequency groan of familiarity. Capt. Brad "Mac" MacKenzie was the Lead AC of this three-ship heavy equipment airdrop currency sortie. Riding along as co-jock was Capt. L.S. Sam, Lt. Blinky Donivan as the Magellan, TSgt. Ty Downs as the primary load, with SSgt. Steve Adore to back him up, and . . . Gadzooks! . . . MSgt. Maxine "Max" Torque as the flight engineer.

Briefing, ground ops, takeoff and assembly were superbly performed. "Couldn't have done better myself, m'lads!" C.R. declared, inhaling his first flight lunch since retirement.

"Coming from you," Captain MacKenzie said, "that is a real compliment. You're quite the legend. Aren't you the one who saved that C-130 in Alaska by jettisoning USO showprops immediately after takeoff? The anti-ice must not have worked as advertised, huh?"

Mildly chagrined, the Rotund One choked on his half-eaten hoagie. Remembering the day he took off without deicing, he said, "Uh. . . yeah, the anti-ice screwed up, that was it!"

The formation settled into a local trainer routine, descending to low level and expeditiously running checklists. They really worked well together, the Retired Reveler thought. Checking his Rolex Oyster Perpetual Chronometer, he schemed, "About time to see what they're made of."

The two loadmasters were just coming forward during the ten-minute checks when the Bulbous Buffoon made his move.

"Mac, this is the jumpseat. I'd like to watch this from the back. Okay by you?"

"Sure, get with the loads. They'll find you a seat to strap into."

C.R. then told Ty and Steve he was going back to look the load over himself and would be right back. Sergeant Downs reminded him, "It could get bumpy real soon, Mr.Terror. Hustle back and get a seat belt on."

This is too easy, C.R. thought, as he ignited his specially-purchased "ACME Smoke Grenade" behind the first platform.

"Hey load! You gotta a lot of smoke coming outta something back there!" the SGTO Superstar exclaimed while huffing his way back up front.

"Pilot, loadmaster!" Sergeant Downs spoke up. "We've got smoke pouring out of the pet

"... Aren't you the one who saved that C-130 in Alaska by jettisoning the USO show props immediately after takeoff?"

rocks! Sergeant Adore and I are getting our smoke masks on and starting back. We'll let you know what we've got."

"Crew," stated the AC, "Oxygen—on, 100 percent."

Within seconds Ty spoke, "The whole platform is on fire! I can't get close enough to see what started it."

Oops, the Master Mischiever thought. This may be better than I had planned, he said to himself as he scampered back up to the cockpit.

"Nav, get a smoke mask and an extinguisher from the flight station, and help out the loads," Mac directed. "Copilot, declare an emergency and tell them we're RTB."

"Why not just drop the platform on the DZ? We're only a few minutes out," suggested Sam.

"Yeah, that's a good idea. Okay, crew listen up. We're going to run a couple of checklists while the guys in back fight the fire, then use airdrop procedures to jettison the load. Engineer, let's start with the Smoke and Fume Elimination Checklist."

The Fumed Smoker was impressed. This crew communicates well and even the copilot had a good idea. But now the coup de grace, C.R. plotted. As Max reached down to get her oxygen mask squared away and take her checklist out, the Academic Atomic Bomb reached over and shut off the fuel to the Number 4 engine.

"Number 4 just failed," Sam squeaked, looking for some plausible connection. "It just looks like it quit, I don't see anything wrong."

"Okay, everybody, let's take them one at a time," the AC said coolly. "Number 4 Fire Handle-Pulled . . . and we'll get to the checklist in a second."

C.R. watched and made mental notes about their performance in the next few minutes. The fire was nearly put out, doors were open, and the nav made a few adjustments assuming a free-fall drop. The copilot warned the CCT, and gave timely calls to ATC. The engineer kept the pace of the checklists down, and prompted responses from the other crewmembers. Captain MacKenzie relinquished lead, broke out and maneuvered to the rear of the formation. Most impressively, he managed to keep everybody on the same sheet of music.

"Pilot, loadmaster. You won't believe it, but I found a smoke canister of some kind next to the rails where the fire started!"

"Yeah?" asked Sergeant Torque, "somebody, or something's been messing in my area, too. The fuel was shut off to Number 4, and I'm positive I didn't do it!"

"What's going on?" asked Mac incredulously.

"Dr. Trayner will love the results of this training scenario," Terror beamed over the intercom. "This is the best ACT lab ever dreamed up. I'm going to like this job after all," he added.

"Mister Terror, are you telling us you are responsible for this?" asked the noticeably perturbed aircraft commander.

"You bet! Best training I've ever given. A definite step toward realism for dull ol' ACT!" continued the Blubbering Bozo.

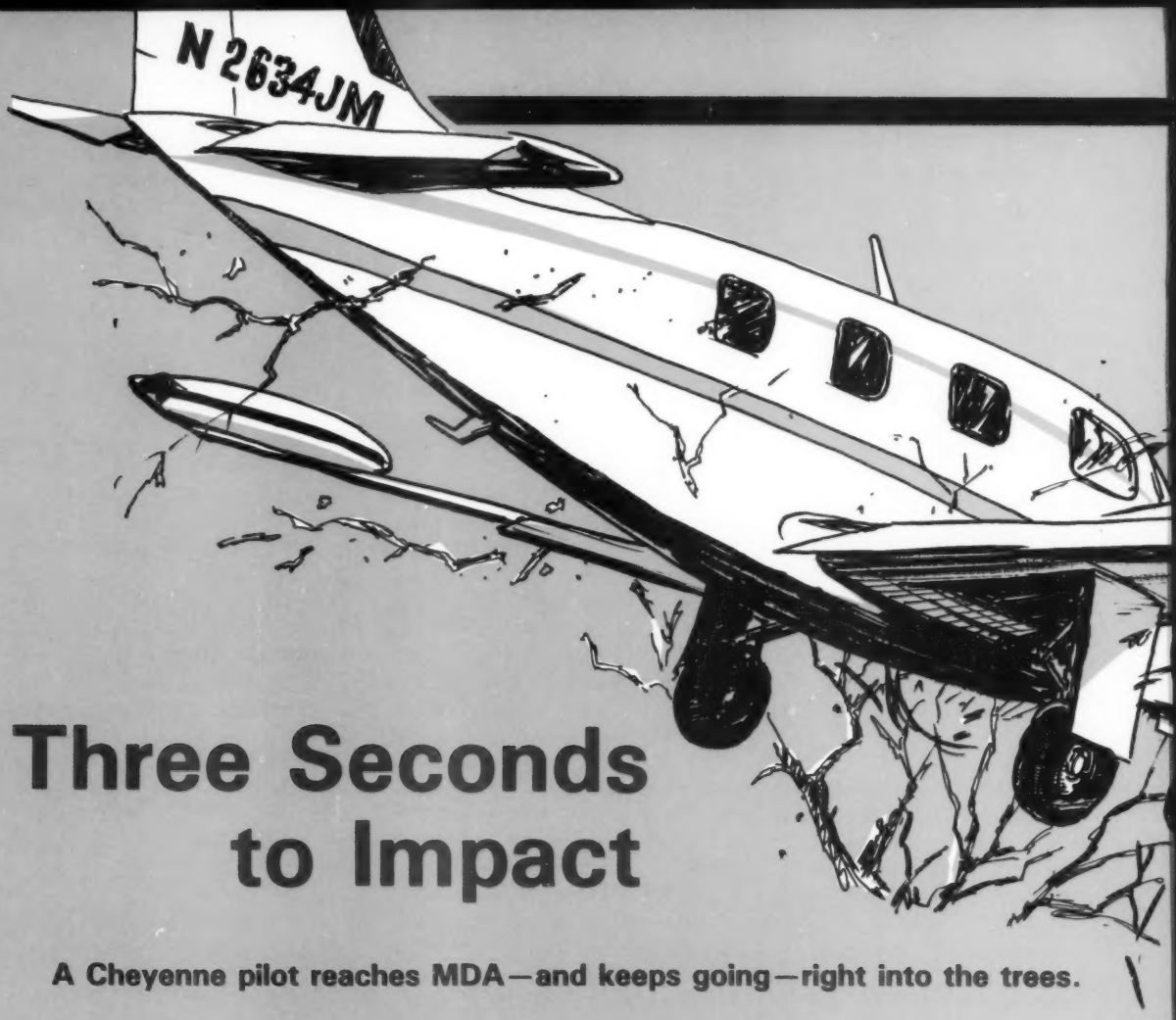
"We'll talk on the ground," said Mac, tersely.

Faster than it takes the lettuce in a flight lunch to wilt, Terror was summoned to Doctor Trayner's office. "You idiot, you almost lost a plane and a crew. We're all up to our keyboards in bad bytes because of you. I'm just happy the ADO, Lt. Col. Fang, Jr., has left it up to me to do what needs to be done."

"But, I did it for ISD" sobbed the Crestfallen Courseware Conceiver.

"You'll have plenty of time to practice that, C.R. You see, we also have the contract for Coast Guard ice breakers at a former station of yours . . . Iceberg NAS. Their entire syllabus needs revision and I need a man of your experience . . . . " ✈

The combined flight experience of our authors is about 60,000 hours, in aircraft as diverse as the C-47, C-123, C-130, C-141, C-5, NC-135, OV-1, 0-2, UV-18B, F-4, FB-111,T-29, T-33, T-37, and T-38, as well as gliders, bugsmashers, and Learjets. They work together, contractor and MAC, teaming to develop the C-17 Aircrew Training System.



Three Seconds to Impact

A Cheyenne pilot reaches MDA—and keeps going—right into the trees.

Non-precision approaches can be tricky beasts, particularly when the weather is near minimums. With an ILS, the pilot has the benefit not only of directional guidance but help with his glide path as well. If the needles are kept centered, the airplane will be right where it's supposed to be, all the way down to the missed approach point.

With a non-precision approach, however, there's a gray area between the time the airplane reaches minimum descent altitude (MDA) and the time the clock runs out. It's up to the pilot to decide when to descend further. Of course, the approaches are designed so there's adequate terrain clearance between the final approach fix and the runway. Still, if the pilot goes below MDA too soon, it's entirely possible the wheels will touch something other than the runway surface before the airplane reaches the airport.

FLIGHT HISTORY

That's what happened on the last day of winter in 1987, near Lawrence, Mass. A Piper Cheyenne II, carrying mail and a crew of two, crashed and burned a mile-and-a-half short of the airport while executing the VOR 23 approach. The pilot and copilot suffered minor injuries, and the airplane was destroyed.

The Cheyenne had begun the contract mail run in Lawrence at about 6 P.M. The flight proceeded to Presque Isle, Maine, about 275 miles northeast. From there, the crew flew to Bangor then to Portland. Weather at Presque Isle was VMC but was worse to the south; Bangor had a ceiling at 800 feet and 1.5 miles visibility in fog and snow; and Portland was reporting a 200-foot broken ceiling and two miles visibility in snow and fog. On the ground at Bangor, the copilot paid a visit to the flight

Mishap With A Moral

service station and learned that Lawrence was reporting 8,000 feet broken and 15 miles visibility.

After Portland, the crew started to press on to Boston but elected to divert to Lawrence to refuel, since they were nearing company limits for fuel reserves. Inbound, the crew was unable to pick up the ATIS for Lawrence, so they called the tower for a weather report. The ceiling had dropped to 1,500 feet and the visibility was down to a mile-and-half; a-half mile above minimums for the VOR 23 approach.

The pilot flew the approach high. The Cheyenne was 800 feet above the published minimum altitude at the final approach fix, and he compensated by increasing his descent rate. The Cheyenne arrived at the MDA right at the missed approach point. The crew saw the runway, but the pilot felt he was too high to make a safe straight-in landing and elected to execute the missed approach procedure. The time was a few minutes before 11 P.M.

The control tower shut down for the night immediately after handing the flight off to Boston Approach Control. Since the tower was the official weather reporting facility for the Lawrence Airport, the control zone no longer was in effect after the tower closed. This altered the approach slightly, increasing the MDA by 80 feet. However, the crew didn't comply with the higher minimums.

Boston Approach told the crew the tower was closed and advised them of an unlighted, 850-foot tower, four miles northeast of the airport. The crew was then vectored for a second approach. The pilot lowered 15-degrees of flaps after turning inbound, and began his descent.

This time, the Cheyenne crossed the final approach fix (Velan intersection, 2.5 miles from the VOR) at the published minimum altitude. The pilot extended the gear and continued to the MDA, with the copilot calling out altitudes as they descended.

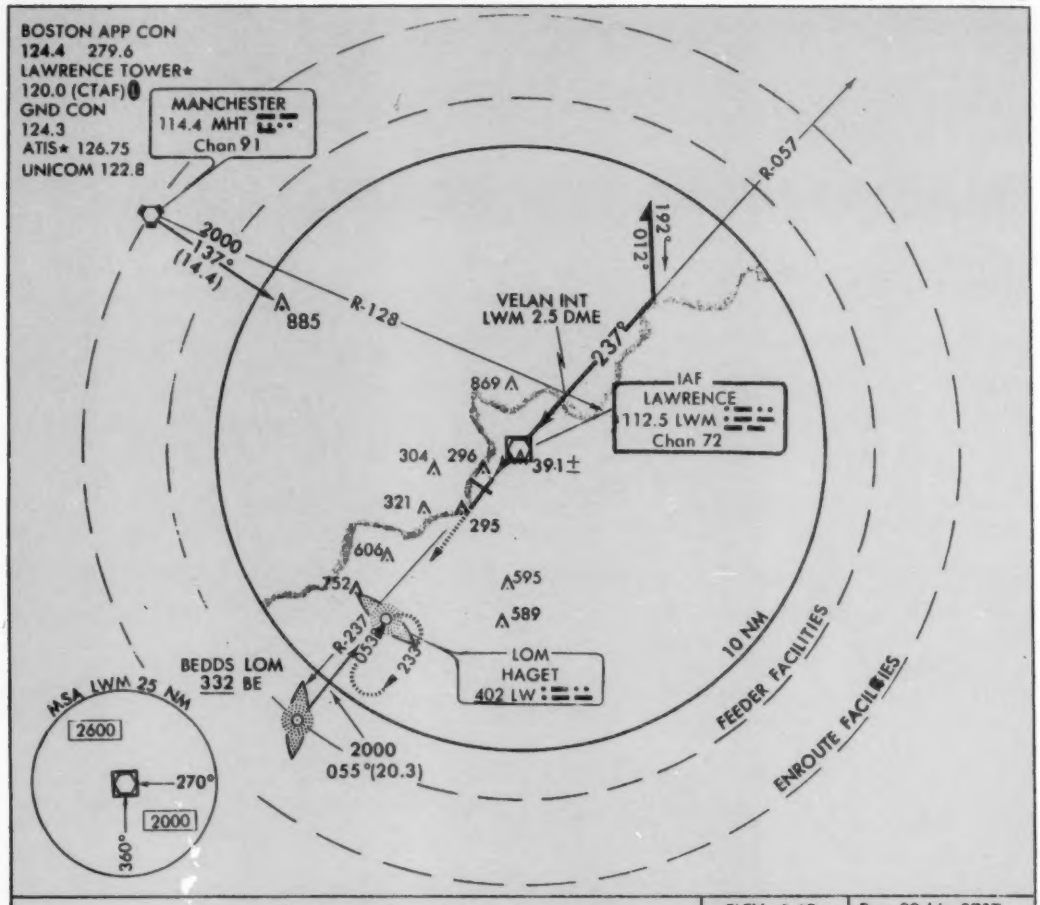
The pilot's and copilot's accounts differ on what happened from here on. The copilot said he made calls 500, 300, and 100 feet above MDA and upon reaching the minimum altitude (660 feet). He said when the pilot leveled briefly at 600 feet, he thought they were going to stay at 600 or possibly go back up to the MDA. The pilot continued to descend below 600 feet, however.

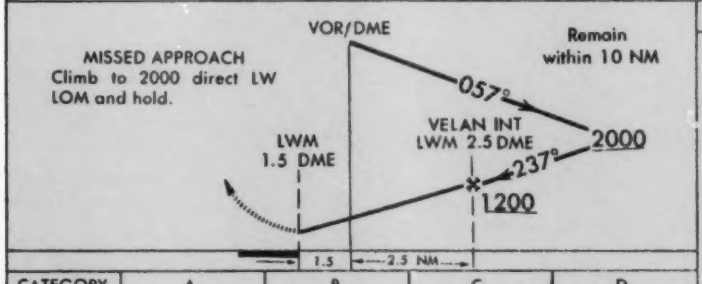
"I repeated, 'Joel, 660'," the copilot said. "He did not respond, and I repeated more firmly, *'Joel, 660.'* At this point I heard him say, 'I'm just going to 400.' I was starting to consider my options at this point when we impacted the trees. If I thought that we were going to hit, I would have taken control of the aircraft, but it was a very short period of time from the point we descended below 660 feet to the point we hit the trees—about two or three seconds. I never saw anything out the windows, not down, not forward, not sideways, *nothing.*"

VOR RWY 23

AL-654 (FAA)

LAWRENCE MUNI (LWM)
LAWRENCE, MASSACHUSETTS

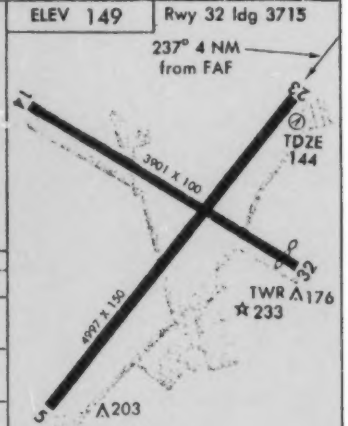




CATEGORY	A	B	C	D
S-23	660-1	516 (600-1)	660-1½ 516 (600-1½)	660-1¾ 516 (600-1¾)
CIRCLING	740-1	591 (600-1)	740-1½ 591 (600-1½)	740-2 591 (600-2)

When control zone not in effect: 1. Use Boston altimeter setting. 2. Increase all MDAs 80 feet. 3. ACTIVATE HIRL Rwy 5-23, MIRL 14-32-CTAF.
ADF required.

NA



FAF to MAP 4 NM					
Knots	60	90	120	150	180
Min:Sec	4:00	2:40	2:00	1:36	1:20

The pilot said the copilot called out the altitudes during descent. "Upon reaching the MDA, we leveled off and the copilot verified this by calling out '660.' At this point we were two-tenths of a mile from the VOR, according to the DME. I acknowledged the to/from flag change upon passing the VOR. At this point, we were maintaining 660 feet. Immediately after passing the VOR, I sighted the Lawrence Airport strobe lights.

"I turned on my landing light and noticed that it was snowing heavily. I started to reach for the flap selector to bring in full flaps and told the copilot that I was descending. As my scan passed the altimeter I saw it was reading 400 feet and said out loud '400.' Before I could react, I heard the sound of the landing gear hitting the trees, and I could only see trees out the window. About two or three seconds elapsed from sighting the runway to impact."

ANALYSIS

The airplane crashed on top of the same hill on which the VOR is located at an elevation of 391 feet MSL, 269 feet below the MDA. According to the pilot, the airplane hit some obstruction lights on the hill that were not illuminated that night.

The National Transportation Safety Board (NTSB) determined that the Cheyenne hit trees on a densely wooded hill at about 120 knots and lost its wings and stabilizers before coming to rest inverted. A hole had been ripped in the fuselage and the copilot was able to get out through it. He then went back and helped the pilot out of the wreckage. A fire had broken out in one of the separated wings, and the pilot tried unsuccessfully to put it out before they left the scene to find help.

The copilot recalled the crash and its aftermath this way: "I could feel my face smash the instrument panel. Next, everything was quiet. I could feel myself covered with fuel and could see and hear fire out my window. I know I never lost consciousness because when all was still, I could hear a gas generator winding down.

"I wormed my way out of my seat. At this point I was completely unaware of the pilot or our attitude. I seemed to be in my own little world, and I had to get out of that plane. I felt no pain but the burning of fuel in the cuts on my face. After freeing myself from the wreck, I ran about 50 to 100 yards and put my face in the snow to relieve the burning. This also seemed a good opportunity to pray, so I took it.

"If the pilot goes below MDA too soon, it's possible the wheels will touch something other than the runway before the airplane reaches the airport."

"I then heard the pilot calling me. It must have been about three minutes since I got out of the plane. I had forgotten he was even there . . . . I went over to the plane to help him out. After trying in vain to break his side window, I guided him out the same hole I used.

"All I can remember about the following moments is being in incredible pain from the fuel in my face. I told the pilot this, but he insisted on putting out the fire. This took about 10 minutes, and he never did get the fire out. I spent this time with my face in the snow (and praying)."

The pilots then walked away from the crash and, after approximately half an hour, found a house and called for assistance.

PROBABLE CAUSE

The NTSB found the copilot's recollections more plausible than the pilot's. If, as the pilot stated, he did not descend below MDA until sighting the approach lights, and hit the trees only three seconds later, then the airplane would have had to be descending at an awesome rate of 5,400 feet per minute. Not the most likely scenario, to be sure.

In the final analysis, the NTSB determined that the probable causes of this mishap were the pilot's failure to follow the published IFR procedure, and his failure to maintain minimum descent altitude until all of the requirements for continuing the approach to a landing were met.

APPLICATION TO MAC

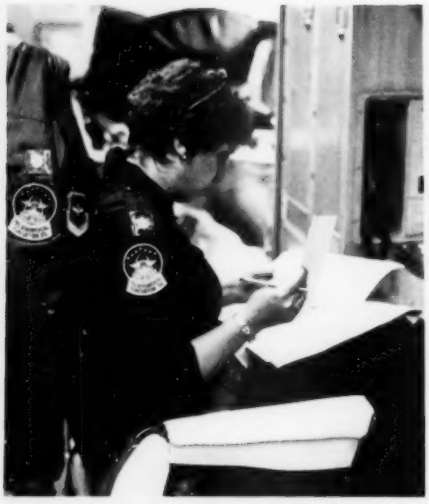
The application to MAC is apparent. We are no strangers to non-precision approaches. The caution against deviating from the MDA until "runway in sight," or reaching the missed approach point has been drilled into us since early pilot training days. Still, we periodically experience mishaps where inattention, visual fixation, or "ducking under" appear in the final mishap report. During these days of heightened tensions, extended crew days, and unsurpassed air traffic congestion, it is more important than ever to concentrate on the job at hand. Safe flying mandates that we take things one step at a time and rely on the basics of sound training practices to keep the operation on track and running safely.

Adapted From: *Aviation Safety, Jun 90, Andrew B. Douglas*

Neonatal nurse monitoring a baby.

Lt. Col. Stanley administering medication to a litter patient.

C-9 Aeromedical Crewmembers



Maj. Buck reviewing a patient's treatment record.

Story and Photos
By Maj. Stephen E. Behr
Associate Editor

It's early morning and a thick blanket of fog fills the Shiloh valley, slowing traffic going to Scott AFB, Ill. Show time is 0600 for the crew of Airevac 636. The small briefing room is filled to capacity with aeromedical crewmembers, an invited medical observer, a chaplain, and a *TMF* editor.

Today, the '636 is operated by a crew made up almost entirely of reservists from the 932d Aeromedical Airlift Group (Associate). The three pilots are from the 73d Aeromedical Airlift Squadron, while all but one medical crewmember is from the 73d Aeromedical Evacuation Squadron. The aircraft commander briefs the departure time, itinerary (eight sorties), scheduled refuelings (three), and weather. Before departing for base operations, he asks if there are any cabin altitude restrictions for patient care today—Maj. Elizabeth A. Buck, Medical Crew Director (MCD), replies "no restrictions."

With the pilots gone, the medical crew listens as a Patient Airlift Center (PAC) nurse gives the "patient report." This report covers patients on the mission with special diets or medical equipment requirements. Patient histories are briefed to give the background needed for correct in-flight care. At each stop, the MCD will be given an update of each patient's condition before they board.

The last medical briefing item covers emergency procedures such as specific duties for handling a cardiac arrest (heart attack) on board the aircraft. Each aeromedical crewmember will have a key lifesaving role to play in the event someone has a cardiac arrest in flight. Several of today's patients have illnesses that could lead to a heart attack.

A voice from the hallway announces the arrival of the crew bus. Time to drag bags. The Flight Nurse, Lt. Col. Sandra L. Stanley, from the MAC Surgeon's staff, picks up the drug kit, while the rest of us load bags and high-value medical equipment. Then it's off into the foggy morning to find our

C-9 and begin preflight.

Blue flight suits worn by the medical crew fill the cabin length with motion as each nurse and medical technician completes the preflight checklist and equipment inventory. Noise accompanies motion as SSgt. Jerondo L. Thompson, Charge Medical Technician (CMT), checks each row of seats for security, and "nurse call buttons" for operation. After a couple of rows, the chiming of the call bell blends with the other preflight sounds.

The Second Tech, TSgt. Ronald L. Mills, inventories and checks each equipment item in the central storage area. After completing the inventory, Sergeant Mills begins setting up cantilever arms to support the litters of two patients originating from Scott. He also installs oxygen regulators at several cabin locations as directed by the MCD.

Below, in the forward baggage hold, TSgt. Doris J. Scroggins, Third Tech, and her instructor, SSgt. Jeffery Carvish, ensure extra cantilever arms are stowed along with two litters and mattresses and two infant car seats. Later, the Third Tech will load and unload patient baggage in the forward hold at each stop. Crew bags, aircraft tech orders, spare tires, and an incubator are put in the aft hold.

Fleet service has delivered sandwich meals to feed patients during flight; these are stowed by Sergeant Scroggins in a large insulated box. In the galley, Sergeant Thompson posted a list of patients requiring special diets, along with their seat assignments. These special meals are prepared in the hospital kitchen and delivered to the aircraft. During this mission, med techs will serve juice on every leg and two meals—one around noon and one in the evening. The entire medical crew helps distribute meals.

Everything is ready and waiting for patient arrival. The red blinking lights of the ambus are faint but grow bright as it gets closer, only to pass and continue along the row of parked aircraft. Our mission is scheduled as the last departure of three airevac missions. The first mission departed just before visibility went to zero. The crew of Evac 636 waits patiently for the ambus to deliver our first patients of the day. At last, the ambus stops in front of our aircraft. It is joined by a fire truck that will remain with the aircraft until the mission is airborne. Two litter and three ambulatory patients accompanied by family members (known in airevac as "non-medical attendants") board the aircraft. Major Buck gives everyone a "before takeoff" briefing over the PA as the med techs demonstrate use of safety equipment and location of exits. When visibility improves, the crew will be ready for engine start and taxi.

Eyes of crewmembers and passengers alike carefully study the fog—is visibility improving or is it just brighter? A radio call to weather confirms the fog is indeed beginning to lift. Crewmembers go to their seats and prepare for departure as engines are started. We follow another airevac from parking to the runway and await our turn for departure.

En route to Forney AAF, Mo., the activity level in the cabin goes up as Colonel Stanley administers medication to a litter patient. During flight, the MCD coordinates and directs patient care and records the progress of each patient on their inflight medical record. At Forney, one litter patient disembarks and a new litter patient and four more ambulatory patients join the flight.

Another short flight to Kansas City International and the C-9 is squeezed into a parking spot at a fixed base operator. As engines wind down, an ambulance is already standing by with more patients for the flight. In 20 minutes the flight is airborne again—headed for Manhattan, Kan. The mission is progressing well—if there are no other delays, the flight will return to Scott close to the scheduled return time.

This should be another quick stop, even with refueling. The C-9 parks on a taxiway since the ramp is too small. An ambus, fire truck, airport manager, and fuel truck approach the front of the aircraft. The airport manager delivers a plate of cookies and a message—call Scott Command Post. The aircraft commander and flight nurse ride in with the manager to phone home. The onload patients wait on the bus as refueling progresses. When the fuel truck is gone, patients are boarded and briefed on emergency exits and oxygen mask use. The flight nurse and aircraft commander haven't returned yet. Major Buck says, "The activity level during a mission has peaks and valleys—right now we're in a valley but don't expect it to last very long."

While stepping off the plane to check the beautiful Kansas weather, I note a fuel truck headed in our direction. This means a definite mission change. There is still no sign of the two crewmembers, but the fuel truck driver says they told him to put on another 6,000 pounds.

A few minutes later, the pilot and flight nurse return—our "routine" mission is now an "urgent." The next stop is Ellsworth AFB, S.D., to pick up a one-month old baby, a doctor, a neonatal nurse, and the child's parents. Two med techs retrieve the incubator from the aft hold. Before it can be positioned, a litter patient must be moved to make room so the incubator can be

TSgt. Mills prepares incubator as TSgt. Scroggins tests a heart monitor.

secured on the litter above him.

There is a peak of activity during the flight to Ellsworth as Sergeant Mills prepares the incubator, a portable heart monitor, and defibulator for use. The other techs serve a meal to all patients and non-medical attendants who are hungry. Patients who boarded back at Scott had breakfast around 0515 or earlier, so they are more than ready for lunch. After the meal, several patients are moved to different seats to make room close to the incubator for those being picked up at Ellsworth.

As soon as engines are shut down, the litter ramp door is opened. The infant, already in an incubator, will be carried aboard, then transferred to the aircraft's incubator. The med techs draft one of the pilots to help carry the incubator up the ramp. The aircraft aisle is crowded as the neonatal nurse moves the child, with heart monitor wires and IV tubes, from one incubator to another. The hospital's incubator is returned to the ambulance by the pilots. As soon as the infant is settled in, the ramp is closed and engines started for the leg to Buckley ANGB, Colo.

During the flight, the neonatal nurse and doctor will concentrate on care of the baby while the aeromedical crew provides an interface with aircraft systems and equipment. The flight crew still has a full load of patients to care for. My seat is close to the heart monitor; the constant beep and changing readout of pulse rate are hard to ignore. As the baby moves and pinches the IV tube, an alarm on the IV pump sounds until it's restarted. Activity on the flight has reached a higher peak.

Descent into the Denver area is marked by light turbulence. The baby's pulse rate has gone up to 175 beats per minute. As the flight gets closer and is configured for landing, turbulence decreases. The landing at Buckley is the smoothest so far on this mission.

All patients will be getting off after the baby is taken care of; no one seems to mind the delay; not even a retired Army four-star. An ambulance brings out another incubator where the infant will be placed for the drive to a medical center. With the transfer of the baby complete, the remaining patients are led from the C-9 onto a waiting ambus.

While the crew chief refuels the aircraft, the rest of the crew go into a "patient waiting" area. Here, Red Cross volunteers have been providing hot dogs and sodas to air evac crews and patients for many years. According to veteran air evac personnel, hot dogs at Buckley are a stateside equivalent to ice cream cones at Berlin.

The MCD and aircraft commander are on the phone coordinating with the Patient Airlift Center and Scott Command Post about the remainder of the mission. One stop will be dropped from the return portion of the mission to keep within the crew duty day. Ground transportation arrangements are made for those patients that will have to get off one stop sooner than planned.

The temperature is 91 degrees, hot for mid-September in Denver. The ambulatory patients are ready for boarding—they've been held in a warm, stuffy waiting area. There is a full load of folks on this flight, including four litter patients. Their ages range from 3 months to 80 years old, and they will all receive quality care during the mission. The mission has reverted back to a routine air evac.

Takeoff and climbout are smooth; the turbulence of an hour ago is gone. After the peak of activity on the preceeding leg, the mission has entered a valley. The patient count drops after each stop as we fly toward mission termination at Scott. After the wait at Forney for an ambus, the mission is airborne again. On the leg to Scott, crewmembers outnumber patients—a rare event.

In the blocks at home station, the med techs begin stowing equipment used during the mission. The blinking red lights of an ambus from the Aeromedical Staging Flight show its readiness to pick up the remaining patients. The pilots depart for maintenance debriefing while the aeromedical crew remains. The flight nurse inventories drugs and medical supplies for restocking. A sergeant from special equipment section exchanges items that must be cleaned or recharged before the next mission. Within 15 minutes, the aircraft's medical equipment is ready for another mission.

A crew bus arrives to return us to the squadron building. Once inside, we find the pilots are on their way home. The medical crew still has work to do before they can depart. Drugs are turned in and inventoried, the PAC is debriefed about the mission, and currency events marked. It is well past the end of the crew duty day when everyone departs for home. They are tired but proud of the mission they perform.

Flying-Hour Milestones

15,000

335 MAS
SMSgt. Lewis Fountain

10,000

145 TAG
CMSgt. Dennis L. Hovis

335 MAS
MSgt. George Liston

7,500

22 MAS
SSgt. Ronald S. Nagy

50 TAS
CMSgt. David E. Rodgers

57 MAS
TSgt. John J. Hart

73 AAS
Lt. Col. Dennis E. Lucido
Maj. Russell L. Hauser, Jr.

145 TAG
MSgt. David W. Harris

185 TAS
Maj. Ronald G. Fowler

702 MAS
Lt. Col. James K. Moran
Maj. David J. McCarthy
SMSgt. Eddie B. Jones, Jr.

5,000

9 AES
TSgt. Michael L. Korn

52 MAS
Lt. Col. Vane Hugo, III.

57 AES
SSgt. Anthony P. Parr

73 AAS
Maj. Donald L. Weimer

86 MAS
TSgt. Michael L. Pierce
TSgt. Edward L. Ungerman

145 TAG
Lt. Col. Samuel A. Coleman

164 TAG
SMSgt. Charles R. Ritter

185 TAS
Maj. Thomas L. Bene, Jr.

328 TAS
MSgt. James H. Shaughnessy

335 MAS
Maj. George N. Bentley
Maj. Alan Greenhalgh
Maj. John McIntyre

702 MAS
Maj. Richard K. Farrell
Maj. Stephen D. Goeman
Maj. Stewart B. Mein, III.
Maj. Douglas C. Uhland
Capt. Wallace H. Cabler, Jr.
MSgt. Leonard Holdsworth

730 MAS
MSgt. Gary L. Pierce

757 TAS
Lt. Col. James R. Wagner
Maj. Mark E. Rensi
Maj. William W. Sassaman, Jr.
Capt. Leslie R. Anzjon
MSgt. Frank J. Marino
MSgt. Joseph D. Pitney

Det 4, 1402 MAS
Lt. Col. John P. Pribie, III.

2,500

9 AES
Capt. Julia M. Burton

9 MAS
Capt. Arthur B. Davies
Capt. John R. Greer
Capt. John M. Renard
MSgt. Scott D. Robinson
TSgt. Steven J. Lediger
SSgt. Thomas E. Bedley
SSgt. Leonard F. Estabrook
Sgt. Jeffrey A. Wisley

11 AAS
Capt. William C. Manning

16 TATS
SSgt Dale C. Schilf

Det 7, 37 ARS
Capt. Charles J. Shoff
Capt. Douglas J. Welch
Capt. Kenneth J. Witte
1st Lt. Ray C. Schultz

Det 9, 37 ARS
Capt. Edward A. Arrington

56 MAS
Lt. Col. Jonathan D. Baethge

57 MAS
Capt. Gregg W. Aselage
Capt. Christopher T. Crawley
Capt. Paul A. Groven
SSgt. Daniel B. Eastman

57 AES
Sgt. Kenneth W. Mayfield

62 TAS
Capt. Timothy S. Costa
Capt. Timothy J. Sullivan
TSgt. Joseph H. Hall
SSgt. James L. Dodds
SSgt. Douglas E. Gardiner

86 MAS
Capt. Christopher B. Hoag

145 TAG
Capt. T. Gordon Thomson
Capt. Dennis R. Black
TSgt. Walton G. Dellinger, Jr.

164 TAG
Capt. Richard R. Chase, II.
MSgt. David S. Leitenberger
MSgt. Thomas R. McCoy, Jr.
TSgt. Jack N. Presley

179 TAG
1st Lt. Stephen M. Larcomb
TSgt. David A. Weidner

185 TAS
Maj. Scott J. Murphy
Maj. Lloyd G. Tidwell
Capt. Robert S. Shafer
Capt. William E. Standifer
MSgt. Norman T. Whitehead

728 MAS
TSgt. Taddeus S. Bryda

1375 FTS
Capt. Amy M. Smellie

Det 1, 1401 MAS
Capt. David M. Alfaro

Det 2, 1401 MAS
Capt. Caleb L. Hamilton
1st. Lt. Todd R. Phillips
Capt. Edward W. Youngling

Ranks and units are those at time of award.

Desert Operations

By H. B. Armitage, Engineering Test Pilot
R M. Holdeman, Engineering Specialist

Climate and special problems imposed by environmental extremes are major factors which must be fully evaluated before any type of mechanical equipment can be operated successfully at a given location. There is usually a close relationship between the degree to which machinery can be protected from the adverse effects of an unfavorable climate and the length of its service life.

In no situation is this principle more readily applicable than in the case of airplanes operated in desert regions. Of all possible climatic extremes, no terrestrial environment is potentially more rapidly destructive to key aircraft components than arid and semiarid regions of the world. Even modern turbine-powered aircraft, regardless of make or type, can be seriously affected by desert operations. It follows that

operational and maintenance techniques which serve to counter the effects of desert conditions will pay substantial dividends in terms of improved aircraft reliability, lower operating costs, and extended service life.

The reason that desert conditions often have such deleterious effects on aircraft can be found in an examination of the desert air itself. The air in desert regions often contains a heavy burden of sand and dust particles that have been picked up from dry surface soils and carried aloft by the wind. These particles are quite small in size and, in the absence of sufficient rainfall to return them to the ground, tend to become more or less permanent components of the atmosphere.

Although dry desert air has long been recommended as beneficial to human sufferers of allergies and certain lung diseases, the effects of an arid climate on precision machinery are less benign. Mechanical equipment is much more vulnerable to damage from airborne sand and dust than are living organisms. An important reason for this is that most living creatures have effective internal systems which help them eliminate any potentially harmful ingested particles. Machines, on the other hand, generally must be protected from solid contaminants in the environment by external devices such as covers, screens, and filters. Even when superbly designed, this type of protection is seldom completely foolproof nor is it practical for all types of equipment. The unhappy fact of the matter is that in sandy or dusty climates, it is next to impossible to prevent at least some particulate matter from reaching internal parts where critical working tolerances can be affected.

With aircraft, the problem posed by sand and dust contamination are particularly difficult to control. It happens that airplanes are often used and stored in such a way that they are exposed to the very worst environmental conditions any locale has to offer. In the desert, this means plenty of heat, wind, and dust. The suspended contaminants in the air, together with the larger particles stirred up from runways and taxiways by propellers and jet exhaust, can penetrate to the interior of even the most carefully protected aircraft components. Once inside, the particulate matter is likely to remain there and cause trouble, clogging passages, eroding surfaces, and converting lubricants into abrasive slurries.

Solid particles carried by the air are clearly the fundamental cause of many of the most serious operational and maintenance problems commonly encountered in desert localities but this is by no means the only problem area. Another source of trouble is heat. The high ambient temperatures typical of many arid regions not only contribute to the dryness, but subject aircraft component sand systems to stresses specifically related to excessive heat. This tends to complicate an already rather challenging maintenance situation.

In the case of turbine powered aircraft, undoubtedly the single most troublesome problem attributable to desert operations is compressor erosion. Each siliceous particle ingested by an engine invariably strikes a compressor blade, vane, or seal; usually at high velocity, and often under conditions of elevated temperature and pressure. It is, quite simply, a form of sand blasting. Over a period of time, even the most resistant of surfaces will wear away under this kind of assault.

It does not necessarily take very much time. Compressor damage due to sand ingestion can show up quite rapidly if the air quality is poor. Remember that when an Allison T56-A-15/-7/-9 power plant is on speed, over 26,000 cubic feet of air is passing through its compressor every minute. With such a large volume the presence of even a relatively modest amount of sand or dust in the atmosphere can make a measurable difference in engine service life.

The principal effect of sand

and dust erosion on compressor performance is a gradual reduction in discharge pressure and volume. This is accompanied by a decline in efficiency and an increase in the incidence of such problems as hung starts, compressor stalls, and engine "bog down"—a condition in which the engine supplies less power than is required to support propeller operation at a given throttle setting.

Unfortunately, power plant damage from ingested sand and dust is not limited to compressor erosion. Among other things, dust-laden air can lead to plugged fuel control compensator probes, abnormal flame patterns in the combustion liners due to dirty fuel injectors, clogged engine anti-icing passages, sluggish bleed air manifold valves, and a general shortening of the service life of many other engine and propeller components because of oil contamination.

Nor are aircraft systems beyond the engines immune from environmentally-caused damage in the desert. Every moving part; every valve, switch, or cam; every duct, passage, or seal may have its function impaired by airborne sand and dust or be degraded by long exposure to excessive heat.

Experience is at the heart of most of the principles and practices that have become established over the years in connection with aircraft operation. So it is with those special techniques which have been found useful in protecting aircraft used for desert operations. No particularly sophisticated or unusually elaborate procedures are involved. What is involved is the consistent application of proven, "desert wise" practices in all situations where the aircraft and the environment interface.

The list of operating and

servicing limits presented here does not by any means exhaust all possible ideas that could help protect your aircraft from harsh climatic conditions, but it does provide a proven database from which to start. Additionally, these operating and service limits are not intended to replace already established procedures and locally established directives, or flight manual guidance. It is not possible to protect an aircraft from all of the rigors of the desert, but the use of these techniques and procedures will make a real contribution toward minimizing the amount of punishment that your Hercules aircraft will have to absorb when it is operated and maintained in the arid regions of the world.

OPERATIONAL RECOMMENDATIONS

1. Taxi with all engines in low speed ground idle (LSGI) whenever possible. This practice will greatly reduce the amount of sand and dust being drawn into the intakes and will also aid in cooling engine oil since less engine heat is developed in LSGI.
2. If it is necessary to use high speed ground idle (HSGI) during ground maneuvering at speeds below 40 knots, avoid moving the throttles below the ground idle detent. Below ground idle, blade action is reversed and blows debris forward where it may be subjected to ingestion by the engines.
3. During sharp turns on the ground (180 degrees on the runway, etc.), use minimum speed and use LSGI on the engines inside the turn to help reduce the possibility that debris will be drawn into the engines.
4. If it is necessary to move the aircraft backwards by using reverse thrust, first stop the aircraft and, while holding the brakes, position the throttles above flight idle to blow the sand and dust aft. Use caution to prevent prop blast damage to other aircraft and facilities as well as injury to personnel. Then move the aircraft backwards, using minimum reverse power on all four engines.
5. The flaps should be retracted during all taxi operations and should be lowered just prior to takeoff. Extended flaps deflect prop blast to the ground during taxi, stirring up debris and increasing the possibility of these particles being ingested by the engines, APU, and air conditioning units.
6. Minimize operation of air conditioning systems during landings and while on the ground to reduce sand and dust contamination of the heat exchanger. Turn off the cargo air conditioning system to aid in this effort whenever possible. The flight station air conditioning may be left on, since its intake is located far enough forward on the fuselage to preclude ingestion of debris thrown up by prop blast.
7. Operate the APU or GTC/ATM only when required for electrical or pneumatic power.This will minimize the ingestion of sand and dust by the equipment.
8. Make the reverse thrust check (prior to takeoff) after engine run-up. Sand and dust will be blown aft during engine run-up; hence, less will be ingested during the reverse check.
9. Minimize flight time in blowing sand or when there is sand and dust in the atmosphere by climbing and descending as rapidly as practical.
10. Cycle the wing, empennage, and engine anti-icing systems during each flight to prevent dust and sand contamination from causing anti-icing valves to stick.
11. During landings, move throttles from FLIGHT IDLE to GROUND IDLE to MAXIMUM REVERSE as soon as practical; then return to GROUND IDLE before ground speed reaches 40 knots. Below 40 knots, propellers move dust and sand forward where these particles are ingested by the engines.
12. If blowing sand or dust is present, install inlet plugs after parking, even during turnaround stops. Install exhaust plugs as soon as the tail pipes cool. Also close the oil cooler flaps.
13. During hot weather operation, avoid sudden power changes. Normal engine acceleration should be experienced; however, engine bog-down is more likely under high-temperature conditions. If engine bog-down is experienced, notify maintenance.
14. Minimize use of wheel brakes, since they will heat rapidly and not cool at the normal rate under high ambient temperatures.
15. To produce the coolest oil temperatures for reversing, taxi, and ground maneuvering in extremely hot climates, manually open oil cooler flaps and select to OPEN and FIXED below 15,000 feet. Remember that oil temperatures above 85 degrees C are detrimental to engine components.
16. Perform NTS checks frequently while operating in these conditions to ensure proper operation of the negative torque systems.
17. Park the aircraft facing into the wind whenever practical. Tailwind starts in high ambient temperatures increase the possibility of "stall starts," over-temperature conditions, and turbine damage. A stall start occurs during an engine start attempt and appears as stagnated rpm at approximately 35 to 55 percent rpm, with TIT continuing to rise uncontrollably beyond start limit.

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Hidden Hazards

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We in MAC routinely fly airdrop routes at altitudes down to 300 feet AGL, so we must be constantly aware of the common hazards associated with low-level flying, such as trees, hills, buildings, powerlines, towers, etc. There is, however, another peril that has received little formal attention in our tactical flying courses—wind and terrain induced turbulence—the kind found near hilly or mountainous terrain. The scientific name is orographic turbulence, and it's downright *dangerous*. This invisible menace not only increases structural fatigue and causes serious aircraft damage, it can force an unsuspecting crew right into the ground. The lower our altitude, the less time we have to react. So, the more we know about it, the safer we'll be able to fly "down in the dirt."

Ridges and Winds

Have you ever flown over a familiar ridge and noticed how effortlessly your flying machine climbed as the aircraft ballooned over the top? Then, a while later, you flew over the same hill only to notice that your beast labored all the way and barely made it over the ridge. After swallowing the apple-sized lump in your throat, did you ever wonder why? Why did it seem so easy to crest the top the first time then barely make it over on the second go around? "Well, it was probably just a 'pig.' Yeah, that's it. The plane was just a 'p-i-g'."

So the next day you're scheduled to go "do it again." You and your trusty beast, different tail number, are terrain-masking

at 300 feet AGL over some pretty rugged countryside. You're thinking to yourself, "Nothing to it." Suddenly, you find the vertical velocity indicator (VVI) showing around 2,000 feet per minute—*down*. You cob in the power and raise the nose. Luckily, you level off at what seems like inches above the ground and wonder, after a brief "thank heavens," why it happened? What was pushing you into the ground?

If you're like most crews and spend at least some of your time in the 300-foot vicinity, your training and "real" experience has been conducted over broad flatlands or low, rolling hills. If this is the case you probably are of the belief that it's all the same. Just don't fly into any rock-filled clouds, right? Again, not necessarily so. If rough or mountainous terrain flying was just like flatland flying, we wouldn't give our pilots specialized training in that type of terrain. You see, the difference between flatland or rolling hills flying at 300 feet, and rugged terrain or mountainous flying at that altitude, is *wind effect*. Wind blowing over and around rough or mountainous terrain can drastically change the picture—possibly for the worst. You may only get a little turbulence, or you may catch the full brunt of an 80-knot downdraft! Your real concern is knowing where the turbulence is and how severe it is.

At low levels near rough terrain, air moves vertically, horizontally, and in eddy currents, creating new and dangerously different turbulence from the type you may have encountered at FL 290 and above. The only thing you may have experienced at 500 feet or below that may be similar to orographic turbulence is low attitude wind shear in conjunction with a thunderstorm. The effects may be the same; loss of aircraft control too close to the ground to recover.

What, How, and When

Orographic turbulence can occur at any time. Basically, when winds blow perpendicular to a mountain range with a velocity of 25 knots or more, you can expect mountain wave turbulence. Talk about a "Rocky Mountain High," mountain wave turbulence can extend up to 70,000 feet and as far as 300 miles downwind from said mountain range. Vertical air turbulence near rugged mountains has been measured at 3,000 to 5,000 feet per minute—a force that may be enough to exceed your particular aircraft's structural limitations. The interesting fact is it takes only 25 knots of wind to create a mountain wave danger. Think about it for a moment. You frequently fly through 25-knot winds and think nothing about the possible danger. The main thing to remember is that the *potential* for significant turbulence is greater when the wind is blowing and you are flying near the surface.

"See and Avoid"

There is no trick to avoiding orographic turbulence. All it takes is knowledge and common sense, and you can even use the available terrain to your advantage. Answering these three questions will put you on the right track:

—What is the wind direction and approximate velocity? (Light, moderate, strong.)

—How will a tailwind affect me as I fly over this terrain?

—How will a headwind affect me as I fly over the same terrain? Now that you have the questions, all you need are the answers. The "trained eye" can predict and help anticipate the answers to these questions. To help "train your eyes," here are some techniques you can practice on your next low-level flight.

You can determine the wind direction and approximate velocity by observing smoke, water, dust, or even wash hanging out to dry. Determining direction is no problem. Determining velocity, though, is a little more

difficult. If smoke is rising nearly vertically, then the winds are light. If the wind is moderately strong, you'll notice the smoke rising at an acute angle. Smoke blowing almost parallel to the ground indicates winds that are, you guessed it, very strong.

Now if you happen to be over a lake, inlet, or similar body of water close to a mountain range, it may be more difficult to figure out the speed and direction of the wind. The easiest way to judge wind direction is to compare your aircraft heading with the direction of wave movement. For example, if the waves appear parallel to your direction of flight, you have a crosswind. If the wave crestlines are perpendicular to your direction of flight, you have a headwind or tailwind. Also, the foam from any whitecaps will appear to slide back *into the wind*, giving a clear indication of direction. The U.S. Navy uses the Beaufort Scale to estimate wind velocity, but here is a simplified scale:

—Smooth water to fully developed waves . . . less than 13 kts (light wind).

—Waves beginning to white-cap . . . 13 but less than 30 kts (moderate wind).

—Full white-cap with blown spray . . . 30 kts or greater and pronounced wind streaks paralleling wind's direction (strong wind).

Obviously, a good weather forecaster and a good navigator are your best sources of wind information, coupled with a good doppler and/or INS. The techniques mentioned above can be used to update their data and give on the spot wind information at a glance.

Clouds can also be helpful if you can "read" them. Take a good look at the clouds which form near the tops of hills or mountains. Their shape and direction of movement will be good indicators of both wind direction and velocity.

Moisture-laden air cools as it rises and condenses to form clouds near the tops of mountains. These clouds travel downwind from the peaks and frequently form long rows of clouds called "cloud streets." Cloud streets will point downwind from the peaks where they form. Soft billowy clouds will indicate light winds and little turbulence. Thin stratus clouds pointing straight away from the peaks, however, indicate strongwinds and potentially dangerous turbulence. These lenticular or laminar-shaped clouds are the real danger signals for you. They shield the most dangerous severe turbulence beneath their formations on the downwind side of the terrain. Remember, if you see clouds like these you can expect winds in excess of 25 knots and severe turbulence.

Tailwind vs Headwind

These are techniques, but techniques which work and are tried and proven. So, just on a guess, which would you say is more beneficial, a headwind or a tailwind?

If you say tailwind, congrats! The safest way to cross rough terrain is with a tailwind. Why? With a tailwind, you'll ride the updrafts as you approach the ridge. With the dominant airflow upward, you can safely "snuggle down" closer to the ridge, if necessary, to prevent detection. You will have a tendency to "balloon" over the ridge, and the stronger the wind, the greater will be the "ballooning" effect. Anticipate this and attempt to cross the ridgeline at a 45-degree angle.

What about turbulence with a tailwind? Take a good look at the terrain on the ridge as you approach it. If it is relatively smooth, there will be little turbulence even with strong winds. If the ridge is very rough, on the other hand, and the wind moderately strong, you can expect some light to moderate turbulence, but the dominant airflow will be up. There will be little danger from downdrafts.

Now let's talk about the effects of headwinds. If you fly toward the ridge into a headwind, the situation changes considerably and you could find yourself directly in the downdrafts and turbulence. You can expect both downdrafts and turbulence to be directly proportional to the wind velocity and ruggedness of the terrain.

Remember, a wind in excess of 25 knots is your signal for increased vigilence. In this case you must increase your safety margin. You'll need additional terrain clearance as you near the ridge. This particular situation

becomes more critical if you have misjudged the height of the ridge and if you have to sacrifice airspeed for climb performance. Now you could find yourself in real trouble. You may arrive just below the ridge crest (where turbulence and downdrafts are strongest) fresh out of airspeed, altitude and ideas. Catch a good down draft now, and you'll be on the elevator going down! Every kind of aircraft in the inventory has been victimized by the kind of orographic turbulence described in this scenario, including MAC types.

Planning Tips

The catch phrase to prevent something like this from happening to you is "keep everything up." Start with your head and go to your altitude, airspeed and engine power. Keeping your head out of the cockpit will (or should) maintain your awareness of what's going on outside—remember those hints about wind speed, direction, and proximity to the ground. If you're flying lead, to keep yourself and your cohorts out of trouble, you might want to think about increasing your airspeed before you arrive at the rapidly approaching ridge. Keeping your "maneuvering momentum" up is another way of describing it.

The basic rule is to beware of rugged terrain plus headwinds. Their sum equals nothing but trouble. Altitude plus energy, together, will make things a lot easier.

The last solution is corrective action should you misjudge elevation, terrain or winds, and cannot clear the ridge. If you have maintained your energy level and have given yourself a little edge on altitude, you can turn away from the ridge. To do this, you're going to have to pull some Gs and trade your extra airspeed for altitude. You'll want to quickly bank away from the ridge toward lower terrain and get your flaps down as soon as possible to increase your stall margin. Detailed techniques should come from your stan-eval and/or tactics shop.

So, if you must cross rugged terrain for any reason, and you have a choice, cross with the wind behind you and pushing you up the slope. Try to plan your crossing where the terrain is less rugged, thus reducing the possibility of strong turbulence and fewer downdrafts. If you must cross rugged terrain with strong headwinds, keep EVERYTHING up! Especially critical are your altitude and airspeed, or "maneuvering momentum." At the first sign of trouble, make a maximum performance "climb" toward the lowest terrain and follow your best radius of turn procedures and techniques.

Down in the Valley

So far, one element of rough terrain flying has been ignored. You probably noticed there were no valleys in these mountains. Valleys, as we all know, are excellent for terrain masking and navigating to the DZ and LZ. The question is how to fly a valley to give yourself the greatest safety margin and the greatest terrain masking? With calm winds, the problem is simplified. In this case, you need to evaluate the valley and select the best terrain features to fly over or around. Specifically, look for the rough dark areas where your particular camouflage paint scheme is most effective; where it will best blend in, and where your shadow will be less distinct. A very important consideration is what position in the valley will give you the best opportunity for evasive maneuvering should you suddenly encounter enemy "triple A" or SAMs.

Adding some wind to the valley will, of course, add some turbulence. Still, if you can avoid rugged terrain which amplifies turbulence, you'll be only a little uncomfortable. Wind blowing *across* the valley is another story. If the threat analysis and terrain masking opportunities are the same, you want to fly on the far side of the valley away from the wind. If the wind is from the left, you want to fly on the right side of the valley two thirds of the way up the side of the ridge. In this position, you can ride the updrafts along the hillside and could take full advantage of these updrafts to help you perform your "pop over" maneuver if necessary. If you had to make a 180-degree evasive turn, you would be turning into the wind, thus shortening your turn radius.

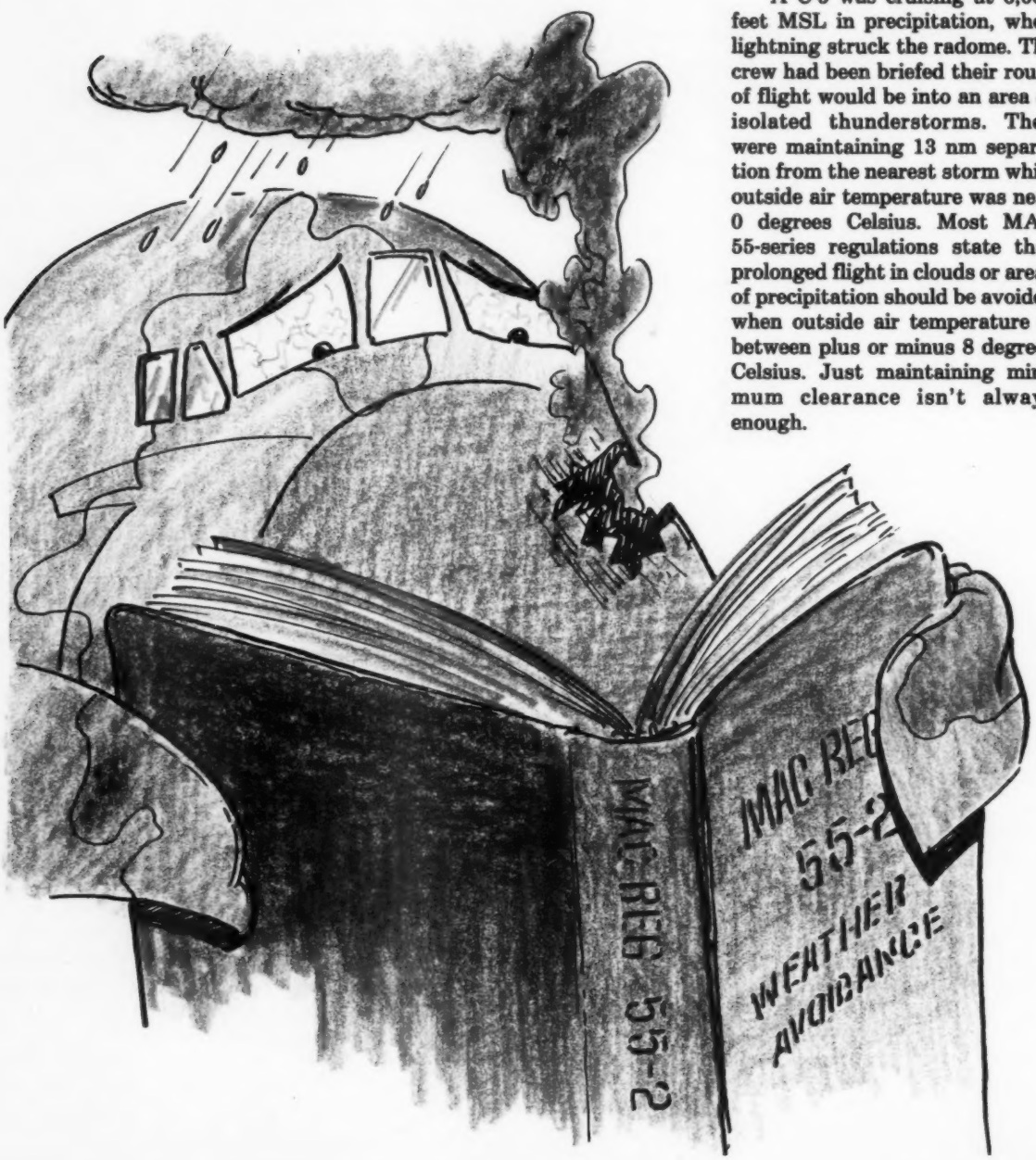
You should try to avoid flying on the downwind side of the ridge. If you fly the left ridge with the wind from the left, you could find yourself flying right into the worst of the turbulence and downdrafts. If this position is the only one you can use, then move farther away from the ridge toward the valley and increase your altitude as much as possible without exposing yourself. Your level of caution should also increase because the likelihood of a downdraft has greatly increased.

Maybe those hidden hazards below 500 feet AGL are a little more "visible" now. Down low, we can learn to read the signals nature provides and, by using them, we can anticipate many dangerous conditions which may be literally "just over the next hill." My hope is that these lessons will be of value to flyers as we continue practicing low-level operations. And, like the man said, the more you practice, the "luckier" you'll get. So practice flying safely and you'll have lots of good "luck." ✈

QUICKSTOPPERS

But We Complied with All the Regulations

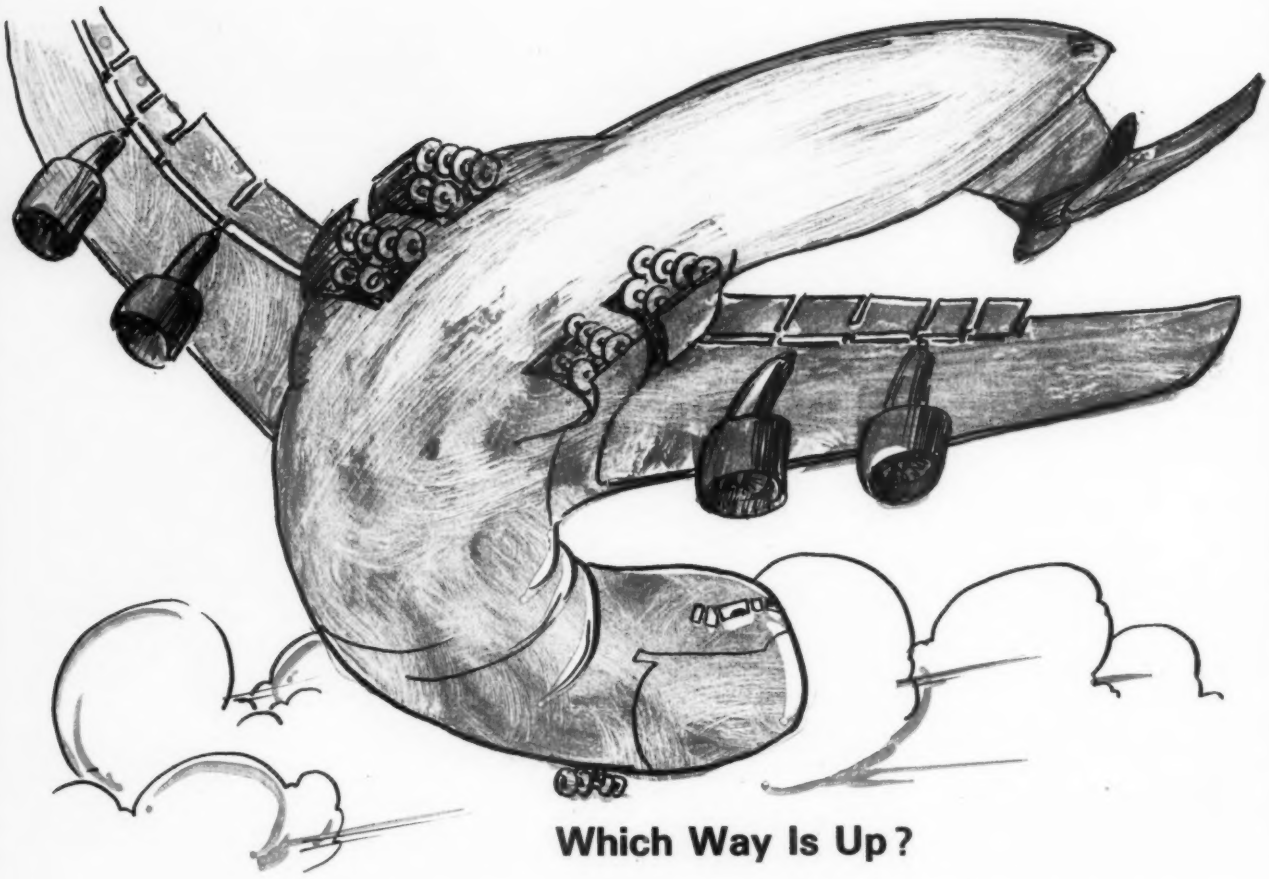
A C-5 was cruising at 6,000 feet MSL in precipitation, when lightning struck the radome. The crew had been briefed their route of flight would be into an area of isolated thunderstorms. They were maintaining 13 nm separation from the nearest storm while outside air temperature was near 0 degrees Celsius. Most MAC 55-series regulations state that prolonged flight in clouds or areas of precipitation should be avoided when outside air temperature is between plus or minus 8 degrees Celsius. Just maintaining minimum clearance isn't always enough.



Static Display Has Moving Experience

The Hercules was late departing home station for a nearby airport's airshow. Before departure, the AC called ahead to find out if they should cancel the mission. The airport manager, who was also the airshow manager, told them to "come on down," there would still be room for them to park.

Arriving over the field, the Herk made a low and slow pass down the runway to check out the ramp area. After landing and taxi-in the crew was directed by airshow personnel, acting as wing walkers along the ramp, to parking. With outboard engines in low-speed and inboards in normal ground idle, the pilot began to turn into parking. As the turn was made, the prop-blast was directed toward a stationary amusement known as the "Moonwalk" located about 50 yards from the ramp. When the prop-blast hit the "Moonwalk," it became a moving amusement, complete with passengers, and travelled about 150 feet. The loadmaster advised the pilot who immediately shutdown engines. Luckily, no one was seriously injured. Static displays seem to always be viewed as "piece of cake" type missions. When operating in close quarters, even low power can have unexpected results.



Which Way Is Up?

A C-5 was at cruise altitude when a power fluctuation occurred and the pilot's ADI gyro flag and HSI power flags came into view. The pilot selected INS Number 3 for attitude and heading reference and the off flags went out of view. The crew then found the Number 1 Power Transfer Relay (PTR) stuck in the alternate position. Once on the ground, the crew chiefs tried unsuccessfully to restore primary power to the Number 1 PTR. When the aircraft taxied out for the next sortie, the PTR shifted itself to primary electrical power and put off flags on the pilot's instruments again. The pilot was able to clear the INS faults and selected INS Number 1 for takeoff. During descent, an electrical click occurred giving the pilots' instruments a "pinball effect." Again, the pilot's ADI and HSI were filled with off flags. The copilot's instruments were fine until three minutes later when another click occurred—now the copilot had red warning flags on his panel. The copilot selected INS Number 3 for heading and attitude—now both pilots had the same information displayed. The crew was looking for the simulator instructor when a third click occured putting warning flags in all the instruments and disconnected the autopilot. Getting closer to their final destination, the crew cleared enough INS faults to remove the off flags. Continuing to fly in visual conditions, they arrived home with the standard uneventful landing.

After Deadlines

MAC BEGINS HUMANITARIAN MISSION TO MIDEAST-Three Military Airlift Command aircraft and crews have joined an international effort to provide assistance to displaced people arriving daily in Jordan. The Department of Defense recently dedicated two MAC C-5s and a C-141 for the sole effort of flying relief missions into the region. The initial C-5, from 436 MAW, Dover AFB, Del., left Andrews AFB, Md., Sep 15. The Galaxy, loaded with humanitarian relief supplies, initially stopped in Islamabad, Pakistan. On its return leg, the aircraft transported 1,500 tents and 750 blankets to Amman, Jordan, 18 Sep. The United Nations Disaster Relief Organization donated tents and DOD contributed the excess property blankets. The second C-5 left for Amman from Dover AFB, Del., 18 Sep. The 436 MAW aircraft transported DOD excess cots and 5,000 blankets donated by World Vision and the Adventist Relief Agency. A C-141 from the 438 MAW , McGuire AFB, N.J., traveled to Jordan, 19 Sep. It carried DOD excess cots and stopped en route at Copenhagen, Denmark. There it picked up about 20 tons of tents, plastic garbage bags and blankets donated by the United Nations Children's Fund. After offloading the cargo in Jordan, the Starlifter flew three missions transporting about 140 refugees on each, to Sri Lanka, Bangladesh, and the Philippines.

UNPAINTED STARLIFTERS RETURN TO FLEET--Several Military Airlift Command C-141s have returned to operational status after programmed depot maintenance, but this time the Starlifters have a different look. All required maintenance was completed but the aircraft were returned to the fleet without perhaps the most noticeable change--new, camouflage paint schemes. Officials at Warner-Robins Air Logistics Center (ALC) Ga., sent the planes back to the inventory unpainted because of MAC's need for aircraft availability. Workers applied the normal coating of alodine and corrosion inhibiting sealant. Alodine is a chemical pre-paint treatment that gives the metal a yellowish tint. This process saved about four days. Because of the command's increased need for operational aircraft, ALC is making an effort to accelerate the completion of programmed depot maintenance of all C-141s.

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AIRLIFT

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We're airlift crewmembers, part of Desert Shield:
With a "go" attitude, but our bodies must yield
To short crew rests and hours of fatigue.
This spirit of airlift, in our hands and eyes,
Lifts our laden aircraft into threatening skies.
Our '130s, '141s, and '5s, among others
Are leading their most productive lives,
Loaded with the condiments of war,
Their cargoes destined for distant sands
Marked by coordinates,
On a dimly lit and worn computer flight plan.
God, we hope that these instruments of war
Can peacefully dissuade this foe.
Why does the call always come at midnight
Which shatters our sleep?
You're now on Bravo, report immediately.
Our lives, like so many others, are now on hold,
Bid goodbye to your families.
Where we are destined cannot be told.
The heroes are countless, their names untold
This saga of airlift steadily unfolds:
From cargo loaders to mechanics,
Fleet service to command and control,
Passenger reps to stage managers,
Refuelers to crew transport,
Billeting to flight line cooks:
Their endless hours are highly extolled.
A crew at Ramstein lost their lives
For Desert Shield—
To their memory, this simple poem is told,
For all Airlifters to remember and cherish,
Those who tragically perished.